C. Large polymers are called MACROMOLECULES

D. Backbones of CARBON called a CARBON SKELETONS with other atoms and molecules attached to give it a particular FUNCTION and STRUCTURE

E. Water is the most abundant INORGANIC compound in the body and it participates in two important biological reactions

1. HYDROLYSIS reactions

   a. Breaking down organic(polymers) by ADDING a water molecule as H and OH
   b. Example: RESPIRATION - breaking down sugar to H_2O and CO_2

2. DEHYDRATION synthesis

   a. CONDENSATION process

   b. BUILD UP large molecules by Releasing one water molecule like $C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$

   C. Two sugar molecule become linked by C-O-C bridge with the loss of -OH by glucose and H+ by fructose to form WATER

V. ENERGY CURRENCY

A. Energy necessary to life processes is available in the form of certain compounds that contain a large amount of energy in their overall structure

B. One of these is ADENOSINE TRIPHOSPHATE or ATP

1. It has 3 linked phosphate groups (PO4) attached to one another by covalent bonds

2. The bond holding the last one is EASILY broken and when broken much more energy is RELEASED then was required to make the bond

3. This conversion of energy is used by the cell to DRIVE chemical reactions that enable the organism to function

VI. MOLECULES OF LIFE

A. Four main classes of organic compounds essential to all living things are all made from C, H and O but in different RATIOS and each with different AMOUNTS

B. The four classes of organic compounds are CARBOHYDRATE, LIPIDS, PROTEINS, and NUCLEIC ACID

c. Oligosaccharides "Few Sugars" short line

1) Examples

a) Glycolipids - _____

b) Glycoproteins - _____

2) Components of cell Membrane

3) For cell recognition - they stick out so they see each other

d. Polysaccharides - complex carbohydrates "many sugars"

1) Formula - $(C_6H_{10}O_5)_n$

2) Chains of Glucose molecules

3) Animals store glucose in the form of the polysaccharide GLYCOGEN which is HUNDRED of glucose molecules strung together in highly BRANCHED chains that is stored in LIVER and MUSCLE, ready for quick energy needs

4) In plants, glucose molecules are linked in polysaccharic called STARCH in two basic forms

a) Highly branched similar to GLYCOGEN

b) Long, unbranched chains that COIL like a telephone cord

5) Also make CELLULOSE which gives strength and rigidity to plant cells - makes up 50% of WOOD

D. LIPIDS (P. 58-59)

1. Elements - C, H and O but H to O NOT 2 - 1, higher H

2. Doesn't Dissolve in water

3. Large number of C-H bonds which store MORE energy than C-O bonds in carbohydrates

4. Building blocks (monomers)

a. Glycerol (ALCOHOL)

b. FATTY ACID - organic acid

1) These are UNBRANCHED C chains- long (12-28 C) with a CARBOXYL (ACID) at one end

2) Carboxyl is POLAR, attracted to water HYDROPHILIC

c) In animals, protective layer also (EAR WAX) to prevent microorganisms from entering middle ear

b. STEROIDS

1. Made of FOUR FUSED carbon RINGS with various functional groups

2. Many animal HORMONES, like TESTOSTERONE, are steroids

3. CHOLESTEROL - needed by NERVE cells and other to function normally (PRECURSOR for other mol.)

E. PROTEINS - every cell with several hundred to several thousand (P.56-57) Like skin, muscles and catalysts of plants and animals

1. Elements - Carbon, hydrogen, oxygen plus NITROGEN (SOMETIMES SULFUR)

2. Building blocks - AMINO ACIDS (20 different kinds)

a. Each AA with a central carbon atom bonded to 4 other atoms or functional groups

b. CARBOXYL on one end, AMINE on the other and

c. R group which is the main difference in the amino acids

1) Can be simple or complex
2) Give the protein very different SHAPES and therefore, FUNCTIONS

d. Essential AA - 8 YOUR BODY CANNOT SYNTHESIZE

e. Nonessential AA - BODY CAN SYNTHESIZE

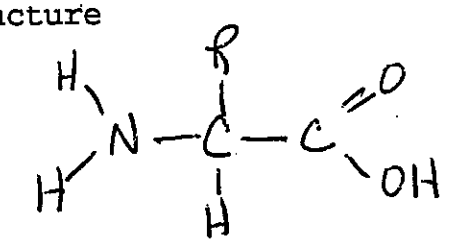
f. Two together = DIPEPTIDE, many together = POLYPEPTIDE

3. Proteins are made of one or more POLYPEPTIDE that bend and fold upon themselves with interactions between R groups

4. Functions

a. Structural components of CELLS
b. MESSENGERS
c. RECEPTOR of messages between cells
d. DEFENSE against disease
e. SKIN, HAIR, MUSCLE, parts of SKELETON
f. ENZYMES - facilitate reactions in cells

5. General structure



2) Takes the name of the substance on which it works - add ASE or IN ending such as ATPase

3) Enzyme reactions depend on a physical FIT between the enzyme and its SUBSTRATE

4) Shapes fit together like a LOCK and KEY

5) Linkage of enzyme and substrate causes a slight CHANGE in the enzyme's SHAPE to conform to the substrate

6) This change of shape WEAKENS the chemical bonds in the substrate which is one way that enzymes reduce the ACTIVATION energy needed (hand in a GLOVE)

7) The enzyme is then released UNCHANGED

Enzyme + substrate = ES complex = EP complex = Enzyme + product(s)

8) Specific substrate depends on small area of TERTIARY structure called ACTIVE SITE

9) This is where specific BINDING and association of other molecules can occur

10) Active site can attract and HOLD only a specific molecule

11) Therefore, each enzyme can catalyze only 1 or a FEW chemical reactions if the molecule fits

12) Characteristics of reactions

a) Often REVERSIBLE
b) Reactions FASTER at higher temperatures but only in a NARROW band (above which it BREAKS DOWN)
c) Varies with pH

13) Coenzymes - organic compounds that HELP enzymes FUNCTION (VITAMINS)

14) Cofactors - INORGANIC compounds that help enzymes function (MINERALS)

15) Enzymes - Isomerase, lipase, dehydrogenase, pepsin, renin

b. Antibodies - IMMUNOGLOBINS

1) HIGHLY SPECIFIC - work for certain disease
2) Binds to a FOREIGN ANTIGEN (proteins from BACTERIA, VIRUS
3) Examples - IgM, IgA, IgD, IgG, IgE
4) THIRD line of body defense against disease-causing organisms - IMMUNITY

e. The sides of the ladder are made of PHOSPHATE and SUGAR and the rungs of the ladder are N. BASES

3. Examples

a. DNA - DEOXYRIBONUCLEIC ACID

b. RNA - RIBONUCLEIC ACID

4. Bonds

a. PHOSPHODIESTER - between acid and sugar

b. N-GLYCOSIDIC - between sugar (glycoside) & base

c. ~~HYDR~~ HYDROGEN between nitrogen bases

5. Function

a. Dictate the AMINO ACID sequence which controls the basic life processes passed from parent to offspring

b. Stored INFORMATION that determines GENETICS characteristics of cells and organisms - GENES

c. Specificity determined by the fact that only certain BASES bond with each other; they are said to be COMPLEMENTARY ADENINE to THYMINE, CYTOSINE to GUANINE

QUESTIONS TO CONSIDER

1. What is an organic compound?
2. What property allows carbon compounds to exist in a number of forms?
3. Define functional groups and give three examples.
4. How does a polymer form?
5. How does a polymer break down?
6. Define monosaccharide, disaccharide and polysaccharide.
7. Describe the structure of amino acids and proteins.
8. How do the two ends of a fatty acid differ?
9. Name the two types of nucleic acids and describe their function
10. Make a chart of the four organic compounds, listing elements, monomers, types of bonds between monomers, the different kinds, an example of each kind and the general function of each compound.
11. What are environmental conditions that can affect the functioning of enzymes?
12. Describe the primary, secondary, tertiary and quartenary structure of proteins.
13. Explain how enzymes act on substrates.
14. Name three differences between DNA and RNA.
15. Differentiate between saturated and unsaturated lipids.
16. Differentiate between cofactors and coenzymes.
17. What is the major energy currency molecule and how is it constructed
18. Make a chart with the functional groups giving structural formula and the type of compounds they make.